

---

## Three New Species of Celastraceae (Hippocrateoideae) from Southeastern Brazil, and a New Combination in *Peritassa*

Julio Antonio Lombardi

Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627, 31270-110, Belo Horizonte, Minas Gerais, Brazil.  
cissus@mono.icb.ufmg.br

---

**ABSTRACT.** The new *Peritassa sadleri* and *Peritassa longifolia* are distinguished by their habit, leaf characteristics, color of flowers, shape of petals, number of ovules, size of inflorescences, and size of fruits. The new species *Salacia nemorosa* is distinguished from other southeastern Brazilian species by inflorescences, disc details, and size and shape of flowers and fruits. The new combination in *Peritassa* is also proposed: *Peritassa glabra* (A. C. Smith) Lombardi.

**RESUMO.** As novas espécies *Peritassa sadleri* e *Peritassa longifolia* são distintas pelos hábitos, morfologia das folhas, cor das flores, forma das pétalas, número de óvulos e tamanho das inflorescências e dos frutos. *Salacia nemorosa* difere das outras congêneres do sudeste do Brasil pelas inflorescências, detalhes do disco e tamanho e forma das flores e dos frutos. Também uma nova combinação em *Peritassa* é proposta: *Peritassa glabra* (A. C. Smith) Lombardi.

**Key words:** Brazil, Celastraceae, Hippocrateoideae, *Peritassa*, *Salacia*.

The former family Hippocrateaceae is today included in the Celastraceae as a subfamily, which includes 5 tribes, 24 genera, and ca. 357 described species (Hallé, 1990; Mennega, 1997) distributed worldwide in tropical and subtropical areas.

The delimitations of the Neotropical genera are notoriously controversial, ranging from 2, *Salacia* and *Hippocratea* (Peyritsch, 1878), to 17 by Miers's (1872) account. In this work I followed Smith (1940), who recognized three genera segregated from *Salacia* L., *Cheiloclinium* Miers, *Peritassa* Miers, and *Tontelea* Aublet, included in the tribe Salacieae with the African *Salacighia* Loesener and *Thyrsosalacia* Loesener (Mennega, 1997).

The genus *Peritassa* is restricted to the Neotropics with 14 species (Lombardi & Temponi, 1999; Mennega, 1997). *Peritassa* was described by Miers (1872) and segregated from *Salacia* by its anthers

with longitudinal dehiscence with a prominent connective and a tubular nectariferous disc.

*Salacia* is a genus of ca. 200 species (Mennega, 1997), distributed worldwide in the tropics and subtropics. Smith (1940) recognized 29 species from the Neotropics. The last comprehensive taxonomic study of the genus, although unpublished, is Hedin (1999), who recognized 38 species in the Neotropics, including 3 new taxa from Costa Rica, Ecuador, and Peru.

The probable paraphyly of *Salacia* s. str. has been pointed out in recent molecular studies (Simmons et al., 2001a, b), but before a more extensive analysis of worldwide representative species on both morphological and molecular aspects, it is premature to propose any generic realignments.

While working on a taxonomic study of Brazilian species of Hippocrateoideae, as part of a study of the Neotropical species, I discovered three new species from the Espírito Santo Atlantic ridge (Serra do Mar): two in *Peritassa* and one in *Salacia*. These newly described species occur in an area with few forest fragments, remnants from a vegetation continuous in the past but almost totally depleted now in Espírito Santo.

***Peritassa sadleri*** Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Itarana, Alto Jatiboca, Faz. Frederico Sadler, 20°00'48.6"S, 40°54'39.9"W, 786 m, 26 Feb. 2003, J. A. Lombardi 5205, A. Salino, R. C. Mota & L. G. Temponi (holotype, BHCB; isotypes, MBM, MBML, MO, NY, SPF). Figure 1.

*Peritassae mexiae* disco brevi-tubulari et antherarum dehiscencia transversali-obliqua affinis, sed habitu, florum colore, petalis orbicularibus, ovulorum numero et fructuum forma et dimensione differt. Etiam *Peritassae longifoliae* hic descriptae affinis, sed habitu, pedicelli dimensione et fructuum forma et dimensione differt.

Small tree, 4–5 m, glabrous, branches terete, lenticellate, sulcate, smooth, with seasonal growth marked by scale-like cataphylls. Leaves opposite; stipules 0.4–0.8 mm long, caducous, triangular,

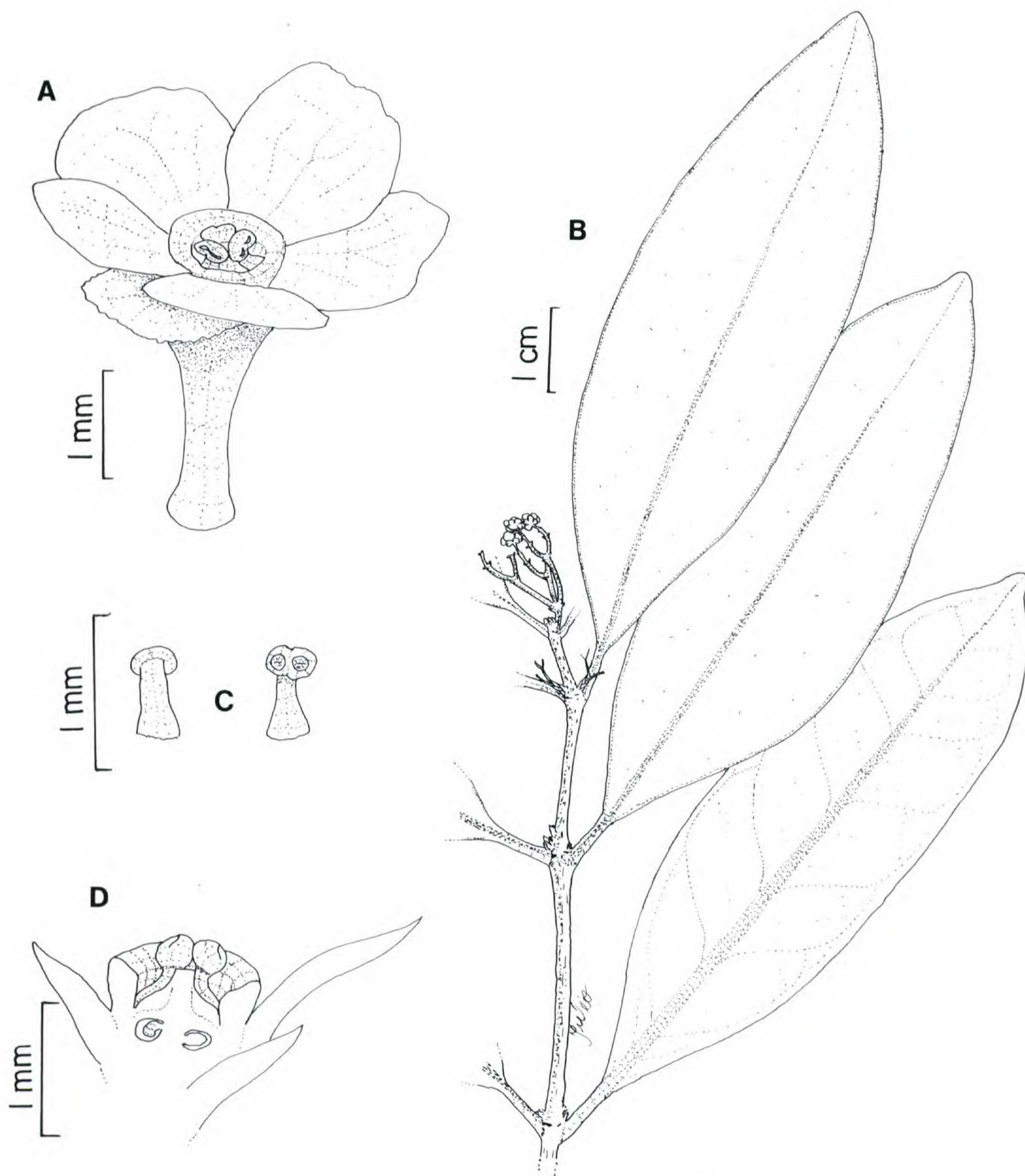


Figure 1. *Peritassa sadleri* Lombardi. —A. Lateral view of flower. —B. Branch with leaves and inflorescences. —C. Lateral and adaxial views of stamens. —D. Lateral view of middle section of open flower showing disc, two stamens, and pistil. Drawn from the holotype, Lombardi *et al.* 5205 (BHCB).

apiculate, minutely erose; petioles 0.4(–0.8) cm, canaliculate; blades 5.9–7.2(14.9) × 1.4–2.8(4.1) cm, elliptic, chartaceous, drying brown, the base cuneate, the apex acute or acuminate, tip cleft or apiculate, the margin entire and thickened, cream-colored when dry, venation brochidodromous with veins slightly prominulous on both sides. Inflorescence thyrsoïd-paniculate, 0.9–1.4 × 1–1.5 cm, with 28 to 49 flowers, axillary, sometimes at leafless

nodes; bracts 0.7–1.2 mm long, triangular, the margin minutely erose, scarious; peduncle 0.1–0.3(–0.7) cm long, terete, in old leafy nodes covered by triangular scales, on new shoots sometimes at leafless nodes and naked, then minutely lenticellate-punctulate; inflorescence branches opposite or subopposite, terete; pedicels (1.2–)1.7 mm long, terete, minutely punctulate, articulate at base; bracteoles 2, opposite at base of pedicel, triangular, 0.4 mm

long. Flowers green, 3.7–4 mm wide at anthesis; sepals 5, 1.2–1.3 × 1–1.1 mm, elliptic, unequal, ± carnose, the margin minutely erose; petals 5, 1.5–1.8 × 1.6–1.7 mm, subcircular, ± carnose, spreading at anthesis, the margin minutely erose; disc annular, short-tubular, ca. 0.4 mm high, 0.2 mm thick, carnose, free from reproductive parts, the margin entire; stamens 3, ca. 0.8 mm long, in open flower exerted and reflexed, the filaments flattened, the connective adaxially thickened, not surpassing the thecae, the anthers ca. 0.17 × 0.42 mm, oblong, slightly emarginate at base, basifixed, dehiscence extrorse by almost transverse apical slits; pistil 0.6 × 0.63 mm, conic, ovary slightly 3-lobed, 3-locular, with 2 subapical ovules in each locule, style ca. 0.16 mm long after anthesis, central, terete, stigmas obscure. Mature drupes 4–6.8 × 2.6 × 2.1 cm, ellipsoid, the epicarp crustaceous, smooth, drying light brown-pruinose, minutely cream-colored punctuate; seeds not seen.

*Phenology.* Collected with flowers and very young fruits in February; collected with mature fruits in October.

*Distribution and habitat.* *Peritassa sadleri* occurs at altitudes of 700–800 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil. This area has many small properties with old coffee plantations and pastures; each of these maintains small portions of forest in varied degrees of preservation in order to fulfill federal government legislation. However protected by environmental laws, the conservation of this species is not sure while it is known only from outside of official conservation sites.

*Etymology.* The specific epithet of this species is an homage to the Brazilian-Pomeranian Sadler family who has preserved an apparently almost intact tract of forest at the intersection of many family members' properties.

This new species resembles *Peritassa mexiae* A. C. Smith by the disc, stamens, and pistil, but can be distinguished by the habit (small tree vs. liana), color of dried leaves (brown vs. cinereous), smaller inflorescences (0.9–1.4 × 1–1.5 cm vs. (0.8–)2.3–5.0 × (0.8–)2.8–7.1 cm), color of flowers (green vs. yellow), shape of petals (± circular vs. elliptic), number of ovules in each locule (2 vs. 1), and bigger fruits (4–6.8 × 2.6 × 2.1 cm vs. 2.4–2.7 × 1.6–2.2 × 1.1 cm). *Peritassa sadleri* is also very similar to *Peritassa longifolia* here described: the flowers are almost identical, but the two species differ in habit (small tree vs. liana), size of the pedicels (1.2–1.7 mm vs. 2.9 mm), and by different

fruits (mature 4–6.8 × 2.6 × 2.1 cm, ellipsoid vs. immature 3.4–4.8 × 2.8–4.2 cm, subpyriform).

*Paratypes.* BRAZIL. **Espírito Santo:** Brejetuba [in sched. 'Brejatuba'], Rancho Dantas, 22 Oct. 2000, G. Hatschbach, M. Hatschbach & J. M. Silva 71523 (BHCB [2], MBM); Itarana, Jatiboca, Alto de Jatiboca, 3 km da Vila Jatiboca, Fazenda da familia Seidler [sic], 19°51'S, 40°52'W, 14 Feb. 1999, E. M. NicLughadha 204, R. Mello-Silva, B. L. Stannard & M. C. Assis (BHCB, K not seen, MBML, SPF).

***Peritassa longifolia*** Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, 750 m, 28 Nov. 2001, L. Kollmann 5055, E. Bausen & W. Pizziolo (holotype, MBML; isotype, BHCB). Figure 2.

*Peritassae mexiae* disco brevi-tubulari et antherarum dehiscencia transversali-obliqua affinis, sed foliorum forma, florum colore, petalis orbicularibus, ovulorum numero et fructuum dimensione differt. Etiam *Peritassae sadleri* hic descriptae affinis, sed habitu, pedicelli dimensione et fructuum forma et dimensione differt.

Lianas, glabrous, branches terete, lenticellate, sulcate, smooth. Leaves opposite; stipules not seen, caducous; petioles 0.7–0.9 cm, canaliculate; blades 7.5–17.7 × 1.9–4.3 cm, elliptic, chartaceous, drying cinereous, opaque, the base cuneate, the apex acuminate, tip apiculate, the margin entire and thickened, venation brochidodromous with veins slightly prominulous on both sides. Inflorescence thyrsoid-paniculate, 1.1–1.8 × 1.1–1.8 cm, with ca. 15 flowers, axillary; bracts 0.4–0.6 mm long, triangular, the margin entire; peduncle obsolete; inflorescence branches arising from an axillary tuft of six triangular scales; branches opposite or alternate, terete; pedicels 2.9 mm long, terete, minutely punctulate; bracteoles 2, opposite at base or middle of pedicel, triangular, 0.3 mm long. Flowers green, 4.6 mm wide at anthesis; sepals 5, 0.8–0.9 × 1.2–1.3 mm, triangular or elliptic, unequal, ± carnose, the margin minutely erose; petals 5, 1.9–2.1 × 2 mm, ± circular, ± carnose, spreading at anthesis, the margin entire to minutely erose; disc annular, short-tubular, ca. 0.3 mm high, 0.2 mm thick, carnose, free from reproductive parts, the margin entire; stamens 3, ca. 0.7 mm long, in open flower exerted and reflexed, the filaments flattened, the connective adaxially thickened, darkened when dry, not surpassing the thecae, the anthers ca. 0.22 × 0.48 mm, oblong, slightly emarginate at base, basifixed, dehiscence extrorse by almost transverse apical slits; pistil 0.6 × 0.7 mm, conical, ovary slightly 3-lobed, 3-locular, with 2 subapical ovules in each locule, style ca. 0.3 mm long after anthesis,

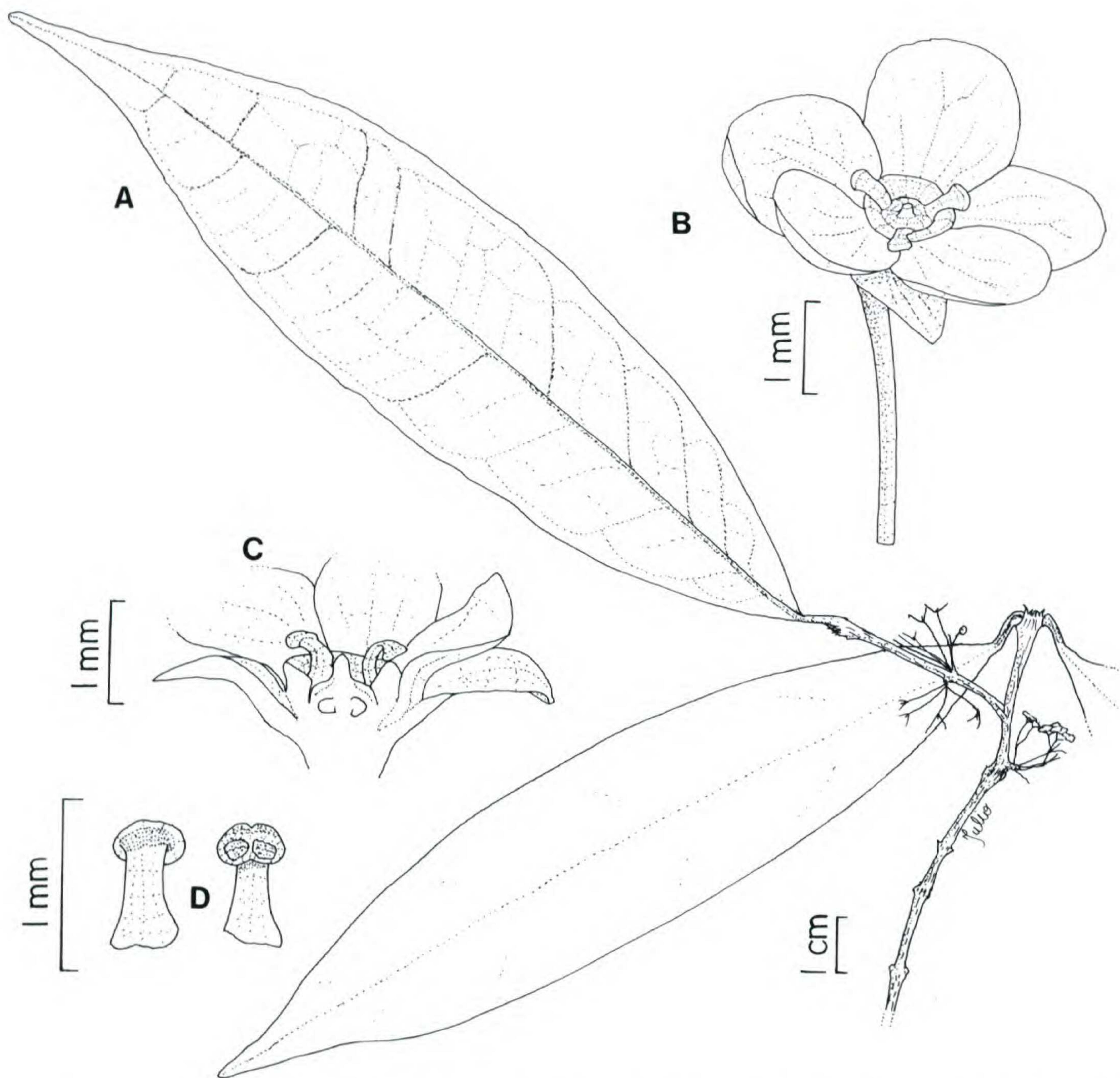


Figure 2. *Peritassa longifolia* Lombardi. —A. Branch with leaves and inflorescences. —B. Lateral view of flower. —C. Lateral view of middle section of open flower showing disc, two stamens, and pistil. —D. Adaxial and abaxial views of stamens. Drawn from the isotype Kollmann 5055 *et al.* (BHCB).

central, terete; stigmas obscure. Mature drupes not seen, immature drupes  $3.4\text{--}4.8 \times 2.8\text{--}4.2$  cm,  $\pm$  pyriform, the epicarp crustaceous, smooth, drying brown-pruinose, minutely alveolate; seeds ca.  $5, 2.3 \times 1$  cm, reniform.

**Phenology.** Collected with flowers in November; collected with immature fruits in April and May.

**Distribution and habitat.** *Peritassa longifolia* occurs at altitudes of ca. 700 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil, and is known only within the limits of the Augusto Ruschi Biological Reserve, an area with 4000 ha of primary rain forest. This area is one of the few intact and relatively large forest fragments in Espírito Santo. The Biological Reserve provides

protection for this species, although the population status is unknown.

This new species resembles *Peritassa mexiae* by the disc, stamens, and pistil, and the dried leaf color and texture, but may be distinguished by the blade apex (acuminate vs. acute), smaller inflorescences ( $1.1\text{--}1.8 \times 1.1\text{--}1.8$  cm vs.  $(0.8\text{--})2.3\text{--}5.0 \times (0.8\text{--})2.8\text{--}7.1$  cm), color of flowers (green vs. yellow), shape of petals ( $\pm$  circular vs. elliptic), number of ovules in each locule (2 vs. 1), and bigger fruits (immature  $3.4\text{--}4.8 \times 2.8\text{--}4.2$  cm vs. mature  $2.4\text{--}2.7 \times 1.6\text{--}2.2 \times 1.1$  cm). *Peritassa longifolia* is also similar to *Peritassa sadleri* described herein, with the almost identical flowers. However, the two species are distinguished by their habit (liana vs. small tree), by the bigger pedicels (2.9 mm vs. 1.2–

1.7 mm), and by different fruits (immature 3.4–4.8 × 2.8–4.2 cm, subpyriform vs. mature 4–6.8 × 2.6 × 2.1 cm, ellipsoid).

*Paratypes.* BRAZIL. **Espírito Santo:** Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, 8 May 2002, R. R. Vervloet 230 & E. Bausen (BHCB, MBML); trilha Roda D'Água, 2 Apr. 2002, R. R. Vervloet 53, E. Bausen & W. Pizziolo (BHCB, MBML).

*Comments on the two Peritassa species described herein.* The transversally dehiscent anther locule and inconspicuous connective group *Peritassa longifolia* and *P. sadleri* with *P. calypsoides* (Cambesès) A. C. Smith, *P. mexiae*, and the former *Ton-telea glabra*, whose combination in *Peritassa* is here proposed; these five species stand apart from remaining *Peritassa* species by their almost transverse anther dehiscence slits and connective not exceeding thecae. However, an intermediary morphology is found in *P. hatschbachii* Lombardi, with its oblique anther dehiscence slits and a connective which slightly or not at all surpasses the thecae.

**Salacia nemorosa** Lombardi, sp. nov. TYPE: Brazil. Espírito Santo: Santa Teresa, Res. Biol. Santa Lúcia, trilha do palmitreiro, 27 Jan. 2000, V. Demuner 621 & E. Bausen (holotype, MBML; isotype, BHCB). Figure 3.

Inter species austro-orientales Brasilienses inflorescentia forma singulari distincta. *Salaciae mosenii* disci forma similis, sed disci externa margine sulco praedito, floribus maioribus et fructibus minoribus pyriformibus distincta.

Trees, ca. 10–12 m, DBH 35 cm, glabrous, branches terete, lenticellate, sulcate, smooth, with seasonal growth marked by scale-like cataphylls. Leaves opposite; stipules 0.6 mm, persistent, triangular, margin denticulate; petioles 0.6–0.7(–0.8) cm, canaliculate; blades (8–)8.9–10.6 × 3–4(–4.9) cm, elliptic, chartaceous, drying brown, the base cuneate, the apex acuminate or acute, tip slightly emarginate, the margin entire and thickened, cream-colored when dry, venation brochidodromous with veins slightly prominulous on both sides, cream-colored when dry. Inflorescence thyrsoid-paniculate, 1.8–2.8 × 1–2.5 cm, with ca. 18 flowers, axillary at leafless nodes; bracts 0.7–1.3 mm long, triangular, the margin erose; peduncle 0.8–1.3 cm, terete, all branches opposite, terete; pedicels (1.9–)2.9 mm long, terete, minutely punctuate; bracteoles 2, opposite at base of pedicel, triangular, 0.7 mm long. Flowers yellow, 4.7 mm wide at anthesis; calyx synsepalous, sepals 5, lobes 0.5 × 1 mm, triangular or elliptic, coriaceous, the margin entire, involute; petals 5, 2.2 × 1–1.2 mm, elliptic, ± chartaceous, spreading at anthesis, the margin undulate; disc ca.

0.6 × 0.4 mm, conical, carnosely, free from reproductive parts, the margin grooved, entire; stamens 3, ca. 1 mm long, at first appressed together around pistil, after exerted and reflexed, the filaments flattened, the connective adaxially thickened, the anthers ca. 0.17 × 0.4 mm, oblong, slightly emarginate at apex, basifixed, dehiscence extrorse by oblique almost transverse apical slits; pistil 0.65 × 1 mm, conical, ovary 3-lobed, 3-locular, with 2 axillary ovules in each locule, style ca. 0.5 mm long after anthesis, central, conical, 3-angled, stigmas obscure. Immature drupes 5.4 × 3.5 cm, pyriform, sometimes ribbed at base, the epicarp crustaceous, drying brown-pruinose, minutely rugose; seeds 1 or 2, 2.8 × 2.3 × 1.5 cm, reniform.

*Phenology.* Collected with flowers in January; collected with immature fruits in October.

*Distribution and habitat.* *Salacia nemorosa* occurs at altitudes of ca. 650–850 m in the rain forests of Espírito Santo, on the southeastern Atlantic coast of Brazil. This taxon is known only from Santa Teresa municipality, which includes the Santa Lúcia and Augusto Ruschi Biological Reserves, areas with 2500 and 4000 ha, respectively, of primary and secondary rain forests inside the city limits. The biological reserves provide adequate protection for this species, which have reproductive populations in different places in Santa Teresa.

This new species is distinguished from all other southeastern Brazilian species by its pedunculate inflorescence; *Salacia elliptica* (Martius ex Schultes) G. Don, *Salacia crassifolia* (Martius ex Schultes) G. Don, and *Salacia grandifolia* (Martius ex Schultes) G. Don have fasciculate inflorescences, while *Salacia mosenii* A. C. Smith has chiefly sessile thyrsoid-paniculate inflorescences and *Salacia arborea* (Schrank) Peyritsch has simple or compound dichasia. It resembles *Salacia mosenii* in its conic disc, but it differs because the disc has a flattened outer margin instead of a groove and larger flowers (4.7 mm vs. 2.4–4.3 mm) and different fruit shape (pyriform vs. spherical).

*Paratypes.* BRAZIL. **Espírito Santo:** Santa Teresa, Alto São Lourenço, Sítio da Cachoeira, 25 Oct. 2000, V. Demuner 1490, E. Bausen & W. Pizziolo (BHCB, MBML); Santa Teresa, Est. Biol. de Santa Lúcia, 22 Sep. 1993, L. D. Thomaz 1722 (BHCB, MBML); Santa Teresa, Res. Biol. Augusto Ruschi, estr. Alto Goiapaba-Açu, 10 Jan. 2002, L. Kollmann 5294 & E. Bausen (BHCB, MBML), 10 Jan. 2002, L. Kollmann 5299 & E. Bausen (BHCB, MBML); trilha da cachoeira, 29 Jan. 2002, L. Kollmann 5361 & E. Bausen (BHCB, MBML); Santa Teresa, Nova Lombardia, Res. Biol. Augusto Ruschi, estr. Goiapaba-Açu, 24 Oct. 2002, R. R. Vervloet 1272, E. Bausen & W. Pizziolo (MBML).

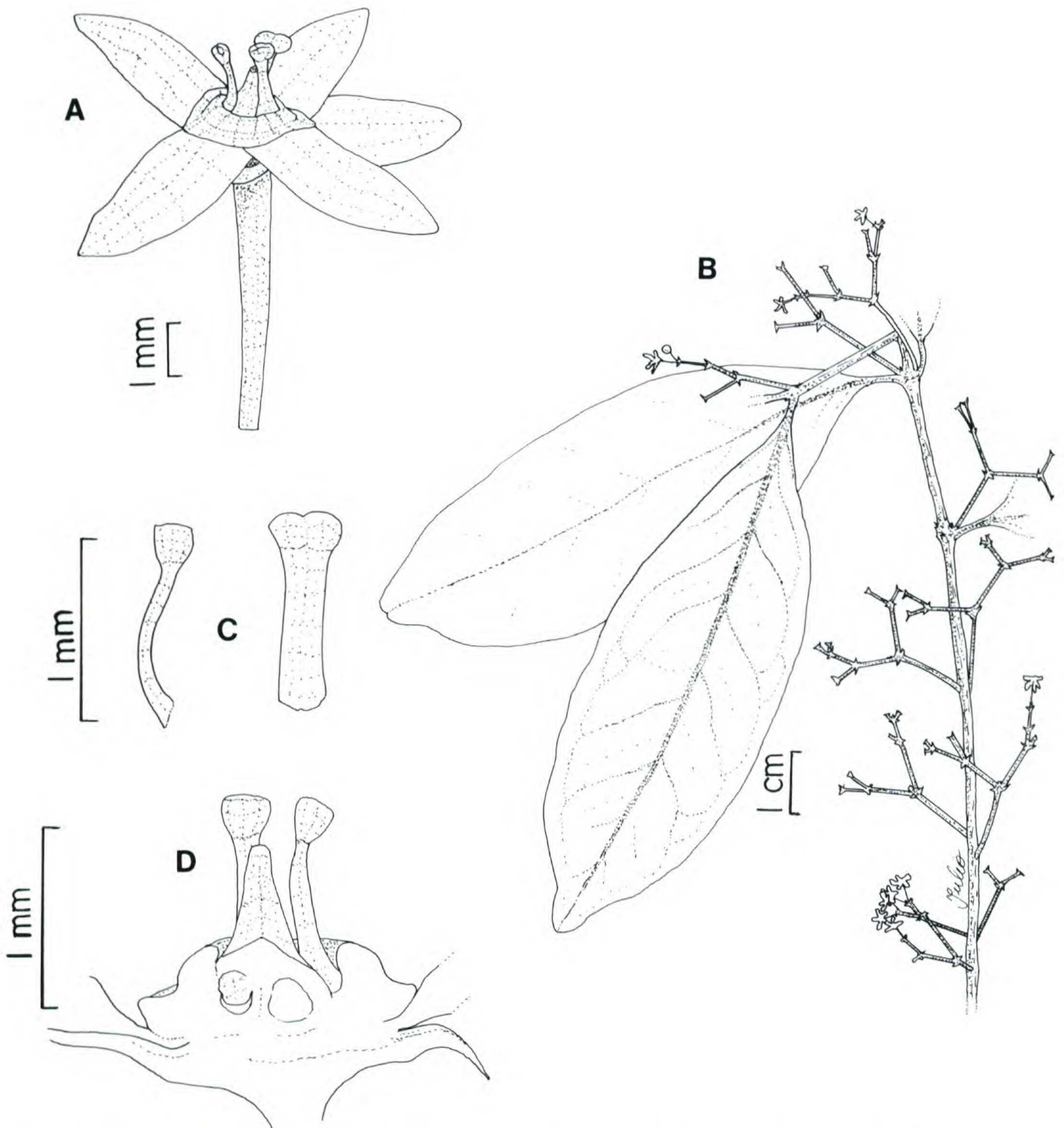


Figure 3. *Salacia nemorosa* Lombardi. —A. Lateral view of flower. —B. Branch with leaves and inflorescences. —C. Lateral and adaxial views of stamens. —D. Lateral view of middle section of open flower showing disc, two stamens, and pistil. Drawn from the isotype Demuner 621 & Bausen (BHCB).

In addition to the aforementioned novelties, a new combination is proposed.

***Peritassa glabra*** (A. C. Smith) Lombardi, comb. nov. Basionym: *Tontelea glabra* A. C. Smith, *Brittonia* 3: 500. 1940. TYPE: Bolivia. La Paz: San Carlos, Mapiro region, 850 m, 5 Feb. 1927, O. Buchtien 1728 (holotype, NY; isotype, F).

Smith (1940) revised the Hippocrateoideae (as Hippocrateaceae) from the Neotropics, recognizing

115 species, including *Peritassa mexiae* A. C. Smith and *Peritassa calypsoides* (Cambèssedes) A. C. Smith. These species have an inconspicuous anther connective and oblique dehiscence clefts, almost transverse, and are distinguished from other fleshy-fruited genera (tribe Salacieae, Mennega, 1997) because the anther locules, although dehiscent by transversal clefts, are not confluent at the apex. The type of *Peritassa calypsoides* was not studied by Smith, who confused this species with a previously undescribed *Peritassa* species, *P. hatschbachii* Lombardi (Lombardi & Temponi,

1999). *Peritassa mexiae* was described based on a single specimen with detached “imperfect” flowers found between the inflorescence branches (Smith, 1940: 518). I examined the isotype specimens (*Y. Mexia* 5206, A, BM, F, GH, NY, VIC), and the flowers referred to by Smith appear to be older dried flowers that had fallen between the inflorescence branches and remained on the sheet. At the same time, Smith described *Tontelea glabra* A. C. Smith (1940: 500), but did not perceive the similarity of this species with *Peritassa mexiae*. I went through the types of *Tontelea glabra* and a number of Amazonian collections from several herbarium collections (CTES, F, IAN, IPA, MG, NY, R, RB, S, U, UB, US) and did not encounter the anther character of “confluent horizontal apical clefts” (Smith, 1940: 501) used by the author for inclusion of this taxon in *Tontelea*.

*Tontelea* in Smith’s (1940: 355) key is distinguished from *Peritassa* by the dehiscence of anthers by confluent slits, while *Peritassa* dehiscence was by non-confluent slits. Almost all species in *Tontelea* have oblong, relatively large anthers (0.2–0.4 × 0.3–0.6(0.8) mm) with clearly transverse dehiscence slits and 3-lobed stigmas, alternate or opposite with stamens, except for the aberrant species *Tontelea cylindrocarpa*, *T. myrsinoides*, *T. nectandrifolia*, and *T. glabra*, which have relatively smaller anthers (0.1–0.3 × 0.2–0.3(0.5) mm) and unlobed stigmas. The transfer of *T. glabra* to the genus *Peritassa* diminishes the morphological discrepancy within *Tontelea*; the generic placement of the other three divergent species remains to be studied.

*Acknowledgments.* The author thanks T. S. Filgueiras for the Latin diagnoses, Victoria Hollowell, Jon Ricketson, and Mark Simmons for critically re-

viewing the manuscript, CNPq for the research fellowship grant (523026/96-0), and FAPEMIG for a financial research grant (CBS-2080/96) as well as the support of the author’s participation in the Brazilian Botanical Congress in 2003. I thank the curators of the following herbaria for the loans of specimens: A, BM, CTES, F, GH, IAN, IPA, MBM, MBML, MG, MO, NY, R, RB, S, SPF, U, UB, US, VIC. Drawings are by the author.

#### Literature Cited

- Hallé, N. 1990. Célastracées (Hippocrateoidées). Pp. 1–247 in B. Satabie & P. Morat, Flore du Cameroun 32. Ministère de l’Enseignement Supérieur de l’Informatique et de la Recherche Scientifique, Yaoundé.
- Hedin, J. P. T. 1999. Systematic Studies of the Neotropical Species of *Salacia* L. (Hippocrateaceae) and Its Relatives. Ph.D. Thesis, Washington University, St. Louis. [Unpublished.]
- Lombardi, J. A. & L. G. Temponi. 1999. A new species of *Peritassa* Miers (Hippocrateaceae) from southern Brazil, and notes on two confused species. *Novon* 9: 221–226.
- Mennega, A. M. W. 1997. Wood anatomy of the Hippocrateoideae (Celastraceae). *IAWA J.* 18: 331–368.
- Miers, J. 1872. On the Hippocrateaceae of South America. *Trans. Linn. Soc. London* 28: 319–432.
- Peyritsch, J. 1878. Hippocrateaceae. Pp. 125–164 in C. F. P. Martius & A. G. Eichler, *Flora Brasiliensis* 11(1). Frid. Fleischer, Lipsiae.
- Simmons, M. P., C. C. Clevinger, V. Savolainen, R. H. Archer, S. Mathews & J. F. Doyle. 2001a. Phylogeny of the Celastraceae inferred from phytochrome B gene sequence and morphology. *Amer. J. Bot.* 88: 313–325.
- , V. Savolainen, C. C. Clevinger, R. H. Archer & J. I. Davis. 2001b. Phylogeny of the Celastraceae inferred from 26S nuclear ribosomal DNA, phytochrome B, *rbcL*, *atpB*, and morphology. *Molec. Phylogenet. Evol.* 19: 353–366.
- Smith, A. C. 1940. The American species of Hippocrateaceae. *Brittonia* 3: 341–555.